



CITY OF GROVE CITY, OHIO
Public & Private Pond Design Standard
March 2006

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LIST OF ATTACHMENTS

City of Grove City Standard Drawing C-GC-24

City of Columbus Standard Drawing AA-S167

City of Grove City Standard Drawing C-GC-4

City of Columbus Standard Drawing AA-S145

LIST OF TABLES

Table No. 1 – Approved Wetland Vegetation List

LIST OF EXHIBITS

Exhibit No. 1 – Submerged Outlet and Embankment Detail

Exhibit No. 2 – Stone Facing Detail for Headwalls

Exhibit No. 3 – Standard Pond Grading Section

Exhibit No. 4 – Conceptual Pond Layout

Exhibit No. 5 – Trash Rack Detail

1 INTRODUCTION

1.1 INTENT

Although every pond is unique and designed based on specific site conditions, the standards set forth within this section are intended to establish the minimum requirements for the layout and design of site improvements within the City of Grove City. Any deviation from these standards must be approved by the Planning Commission and Council (per Section 1101.05, Minimum Land Development Standards, of the Grove City Codified Ordinance 1101 Development Standards).

1.2 COMPLIANCE REQUIRED

The design of any improvements including and adjacent to all ponds and stormwater management basins shall conform to the standards set forth within this section and those stipulated in Grove City Ordinance 1101 Development Standards (sections 1101.01, 1101.02 and 1101.05). The development plan should set forth the character and general details of the pond design and associated amenities. The site and/or construction plan, engineering documents and specifications must include all pertinent details for any permanent water feature.

1.3 DEFINITIONS

Detention Basin: a facility designed for the temporary storage of stormwater runoff for the purpose of delaying and attenuating flow to the downstream receiving system. For the purpose of this design manual, this definition excludes storage in areas of parking lots, rooftops, underground tanks and other water quality-based applications, such as bio-retention basins. These alternative means of providing detention must receive separate approval from the City's Planning Commission and Council.

Note that per Section 3.2 General Requirements all detention basins installed within the City of Grove City shall be wet ponds with a permanent normal pool.

Dam: an artificial barrier usually constructed across a stream channel to impound water. Dams must have spillway systems to safely convey normal stream and flood flows over, around, or through the dam. Spillways are commonly constructed of non-erosive materials such as concrete. Dams should also have a drain or other water-withdrawal facility to control the pool or lake level and to lower or drain the lake for normal maintenance and emergency purposes.

Dike: an artificial barrier used to divert or restrain flood waters from tidal bodies of water.

Levee: an artificial barrier that diverts or restrains flood waters from streams and lakes.

2 EXISTING POND INVESTIGATION REQUIREMENTS

When existing pond(s) are proposed to become part of a storm water management system to be incorporated into a development the following minimum criteria must be met.

2.1 GEOTECHNICAL INVESTIGATION

A geotechnical report must be submitted to the City of Grove City Service Director and Consulting Engineer and shall include the following information.

- Photos of the existing pond(s) and detailed boring locations.
- Discussion of the current conditions, including the presence of trees, inlet/outlet structures, etc.
- A proposed usage description outlining any changes, including increased embankment height, inlet/outlet structures, etc.
- Determine that proposed changes meet requirements set forth in this standard under Section 3.5 Geotechnical Considerations.

2.2 VERIFY EXISTING CONDITIONS

Evaluate existing pond(s) and provide documentation that verifies the capacity of the pond. Also provide documentation that shows that the existing pond(s) have adequate capacity to handle additional stormwater flows resulting from area development. If the existing pond(s) do not meet capacity needs, provide recommendations to increase capacity to City of Grove City Service Director and Consulting Engineer for approval.

2.3 OPERATION AND MAINTENANCE

Prior to area development that will impact existing pond(s), an agreement outlining responsibility of the current and future operation and maintenance of the pond must be documented by the developer and provided to the City of Grove City Service Director.

3 POND DESIGN

3.1 DAM SAFETY CLASSIFICATIONS

Should the basin qualify as a Class I-IV structure under the State of Ohio's Dam Safety regulations [Title XV, Chap. 1521 of the Ohio Revised Code, Rule 1501:21-13-01], then the structure must also meet all applicable criteria of those regulations.

The following dam types do not require construction permits per Ohio Dam Safety Laws, Section 1521.06.

- A dam that is or will be less than 10 feet in height and that has or will have a storage capacity of not more than 50 acre-feet at the elevation of the top of the dam, as determined by the chief. For the purposes of this section, the height of a dam shall be measured from the natural stream bed or lowest ground elevation at the downstream or outside limit of the dam to the elevation of the top of the dam.
- A dam, regardless of height, that has or will have a storage capacity of not more than 15 acre-feet at the elevation of the top of the dam.
- A dam, regardless of storage capacity, that is or will be 6 feet or less in height.
- A dam, dike or levee that belongs to a class exempted by the chief.

3.2 GENERAL REQUIREMENTS

Within the City of Grove City, all detention basins shall be wet ponds, with a permanent normal pool. The ownership and maintenance agreements associated with any pond must be resolved with the City prior to approval of the development plan. Final design of all ponds intended for use as a detention basin must adhere to the requirements for the control of the rate of stormwater as mandated by Grove City's Codified Ordinances (Ordinance 1101 Development Standards, Section 1101.05).

3.3 OUTLET/INLET TREATMENT

3.3.1 Submerged Outlet/Inlet Structures

The City permits the use of submerged storm pipes in lieu of the requirement for stone-facing of an exposed outlet/inlet structure (see Section 3.3.6 Wall/Façade Appearance). Submerged Outlets may consist of a siphon pipe where such pipe is no smaller than 12-inches in diameter (refer to Exhibit No. 1). For smaller outlet requirements, a bolted-on orifice plate may be used as the control feature, to be placed at the structure within the embankment (refer to Exhibit No. 1). The siphon pipe material must be concrete. When using a submerged outlet, a stormwater detention basin must also include one or more additional stage outlet(s) with sufficient capacity to convey the 100-year storm discharge without overtopping the pond embankment.

Inlet pipes that are equal to or larger in diameter than 36-inches must be submerged to at least the "springline" of the pipe (i.e., normal pool at a depth equal to the elevation at one-half the diameter of the pipe). The remaining exposed portion of pipe headwall must include stone-facing (see Section 3.3.6 Wall/Façade Appearance). When an inlet pipe is at least partially submerged at the pond, the conditions listed below must also be met.

- Submergence of inlet pipes is limited to the next upstream manhole or catch basin along the storm sewer system.
- All lengths of submerged storm pipe shall include “o-ring” sealed gasket pipe joints.
- All lengths of the submerged storm pipe shall have bedding and backfill material consistent with the compacted embankment material.

3.3.2 Riser Outlet Structures

Catch basins/manholes used as the outlet structures may have a maximum elevation that is no more than 1.5 feet above the normal pool elevation and may include windows and grate-top openings. Where a catch basin is used as a second-stage outlet structure, the slope of the pond embankment must be graded to reduce the visibility of the structure. Calculations must show that the capacity of the window(s)/grate top does not exceed the capacity of the “barrel” of the riser structure (calculated using the orifice equation).

3.3.3 Structure Requirements

All headwall structures shall be in accordance with City of Grove City Standard Drawing C-GC-24 (36-inch diameter or less) or City of Columbus Standard Drawings AA-S167 (greater than 36-inch diameter). All riser structures shall be in accordance with City of Grove City Standard Drawing C-GC-4 (modified as necessary).

3.3.4 Bedding/Backfill Material

The bedding and backfill material for all storm pipe outlets shall consist of 100 percent cohesive embankment material or controlled-density fill. Where inlet storm pipes are submerged, bedding and backfill material for those pipes shall consist of 100 percent cohesive embankment material to the next structure upstream along the storm sewer system.

3.3.5 Anti-Seep Collars

Anti-seep collars shall be used at all outlet storm pipe locations and shall be located (spaced) and sized in accordance with the criteria provided below. All anti-seep collars shall be constructed with material that provides a watertight connection to the pipe and is of a material that is compatible to the pipe. Anti-seep collars shall also be used along the submerged portion of any storm inlet pipes.

The anti-seep collars shall be located along the length of the outlet pipe within the saturation zone of the embankment (refer to Exhibit No. 1), at approximately equal spacing and at intervals not exceeding 25 feet. The saturation zone is considered to extend through the embankment from the elevation of the riser (normal pool) to the downstream embankment toe.

The anti-seep collars shall be designed to increase the length along the line of seepage (along the outlet pipe) by at least 15 percent. The proper design of the anti-seep collars may be achieved by either:

- Selecting the number of collars and determining the minimum projection of the collar away from the outlet pipe: $V = 0.075 \times (L/N)$; or
- Selecting the projection of the collar away from the outlet pipe and determining the minimum number of collars: $N = 0.075 \times (L/V)$

V = collar projection in feet

N = number of collars

L = length of outlet pipe within the saturation zone

3.3.6 Wall/Façade Appearance

All headwalls, endwalls, catch basins or exposed structures within the pond are required to include natural or manufactured stone facing on the exposed faces of the structure. Stone is to be north shore buff limestone. Alternate selections must be approved by the City Service Director. A sample pallet is to be submitted to the City's Service Director for approval. Refer to Exhibit No. 2 for a graphical representation of the required stone facing detail and related features.

3.3.7 Emergency Spillways

Emergency Spillways, when included in the designed pond outlet feature, must meet all of the following criteria.

- They shall not operate (convey flow) for any design storm less than the 50-year event;
- They shall be reinforced with concrete or designed erosion control materials (geotextiles) consisting of 100 percent synthetic, non-biodegradable materials [the plans should include a specification for the intended geotextile, referencing the required physical properties or the specific material. Reference the State of Ohio, Department of Transportation Construction and Material Specifications Section 712.11, Type "E".
- They must include a designed "control section" that, when combined with the capacity of the principal spillway, will pass the major storm flood discharge up to the 100-year event [the plans must include a detail demonstrating the necessary dimensions of the control section, both width and breadth].

3.3.8 Miscellaneous

The following general criteria must be met.

- Roof drain (downspout) outlets directly to the pond are not permitted.
- All orifice plates shall conform to the requirements of City of Columbus Standard Drawing, No. AA-S145. The minimum allowable installed orifice size is 4-inches in diameter.
- All inlet structures (e.g., pipe headwalls) must be recessed into the adjoining pond grading to diminish the amount the structure is visible.

3.4 POND GRADING

Refer to Exhibit No. 3 for a graphical representation of the required pond grading and related features.

3.5 GEOTECHNICAL CONSIDERATIONS

Design of pond liners and embankments shall be by a qualified geotechnical engineer or geologist. Acceptable soils used in pond liners or embankments shall meet the following minimum criteria.

- Free of large rocks, roots, limbs and other deleterious materials which would adversely effect the design integrity of the liner
- Classified under the Unified Soil Classification System as CL, CH or SC
- Minimum 15% passing the No. 200 sieve
- Have a plasticity index (PI) greater than or equal to 15
- Have a laboratory permeability of 1×10^{-6} cm/sec or less based on a minimum of two undisturbed core (tube) samples taken from the liner

3.5.1 Pond Liner

Pond liners consisting of acceptable soils as described above shall be a minimum of 2-feet in thickness. Localized granular, organic, or other deposits (which would be sources for pond leakage) must be removed and replaced with suitable soils. Disking of up to 6-inches of surface material for re-compaction is acceptable, if necessary. The material must be compacted at optimum moisture content to (but not exceeding) 3 percent above optimum moisture content in loose lifts not to exceed 8-inches in thickness. The installation of pond liners shall be under the supervision of a geotechnical engineer, geologist or other City of Grove City approved entity who shall certify that the liner was installed in accordance with this policy. Alternative pond liners accompanied by a geotechnical report may be used upon review and approval by the City of Grove City. These include, but are not limited to poly-liners (minimum 30-mil) and bentonite (typically 1 to 3 lb/ft²).

3.5.2 Embankment Materials

All outlet embankment materials shall consist of cohesive soils compacted to a minimum of 98 percent of the maximum density obtainable with the Standard Proctor Test method (ASTM Standard D-698). Certified test results must be submitted to the City prior to installation or the test is to be performed at the time of installation, in the presence of the City or their assigned representative. The compacted outlet embankment shall be free of vegetative material and other construction debris. The engineering plan shall include notes and other references regarding the conditions and requirements for construction of the outlet embankment, including design information for a key trench, if necessary.

4 AMENITIES

Refer to Exhibit No. 4 for a graphical representation of the required pond and surrounding area layout.

4.1 OBSERVATION/FISHING PLATFORM

Any pond that includes an incoming storm water pipe of 30-inches or greater may be required to include at least one platform made of wood or other material approved by the City of Grove City Service Department. The size of the platform must be a minimum of 10' x 10'.

4.2 WALKWAY

All ponds must include a 4-foot bituminous walkway around the circumference of the pond edge. The walk may be at generally the same elevation around the pond but must vary in distance from the normal water surface. The construction of the path will be in conformance with the City of Grove City Standard Specifications.

4.3 LANDSCAPE

All detention ponds are required to meet the minimum standards for landscape plantings based on information contained on Exhibit No. 4. All ponds must be seeded or sodded within 21 days of the completion of rough grading of the basin and reserve area.

4.4 FOUNTAINS/AERATORS

All detention ponds are required to include one (1) fountain for every $\frac{3}{4}$ of an acre of surface area, unless otherwise approved by the City's consulting engineer. In addition, the pond must include an air diffuser below the fountain to improve water circulation and quality.

4.5 DEPTH OF WATER SURFACE ELEVATION

The water surface elevation is a critical aspect of the general aesthetics of a detention pond. For this reason, the proposed water surface elevation must not be any lower than 5- feet below the adjoining roadway or viewing area. The viewing area is defined as the level area above the freeboard of the pond. This area may be comprised of the finished floor elevation of the homes nearest to the pond or the finished grade between the nearest homes.

5 WATER QUALITY

In addition to the requirements for this section, refer to the City and State regulations for NPDES requirements (Ohio EPA Permit No. OHC000002).

5.1 TRASH RACKS

At a minimum, all outlet structures shall have a grate to prevent large debris from passing through. Trash racks may be constructed from galvanized metal (rebar) and shall meet the specifications provided below.

- Catch Basin Riser Structures shall have imbedded rebar at all window openings with a height of 1-foot or greater, spacing not to exceed 4-inches, and a pre-fabricated grate top.
- Pipe and Headwall Structures shall have a fabricated galvanized metal grate of the type similar to that shown on Exhibit No. 5. The City, upon review, may approve other types and forms of trash racks.

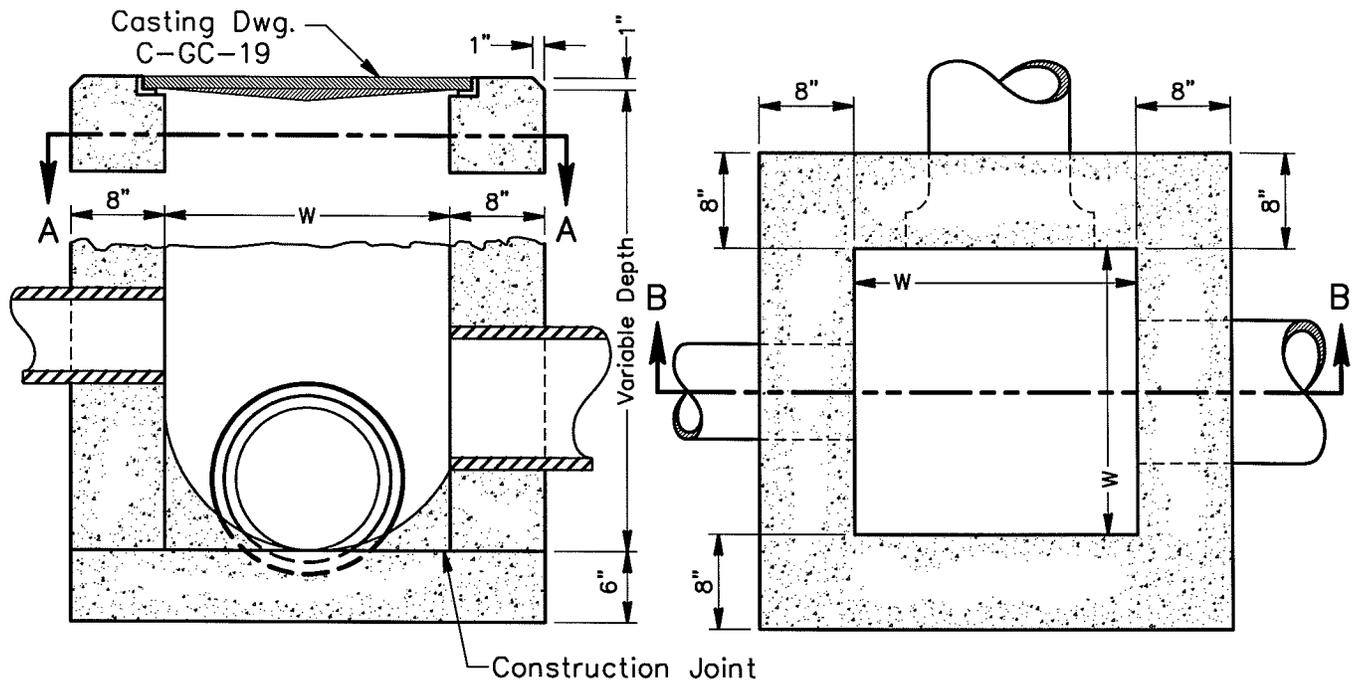
5.2 POND VEGETATION

The City permits the planting of wetland species vegetation within designated areas of a pond for purposes of general water quality considerations or as mitigation in conformance with the requirement for State of Ohio 401 Water Quality Certification. The wetland planting area must not exceed 50 percent of the total pond surface area. Refer to Table 1 for a listing of acceptable wetland species vegetation. Deviation from the plants listed in Table 1 must be submitted to the City's Urban Forester and Consulting Engineer for approval.

5.3 TREATMENT OF ALGAE

The use of herbicides/pesticides to control the growth of aquatic vegetation is regulated by the State of Ohio. Private or public ponds that are within the regulatory jurisdiction of the State of Ohio are subject to the criteria of the Ohio Surface Water Regulations (Ohio Administrative Code 3745-1 Water Quality Standards), pertaining to the application of chemicals within the pond. Refer to the following website for information regarding notification to the EPA prior to applying aquatic herbicides in ponds: <http://ohioline.osu.edu/a-fact/0013.html>.

ATTACHMENTS



SECTION B-B

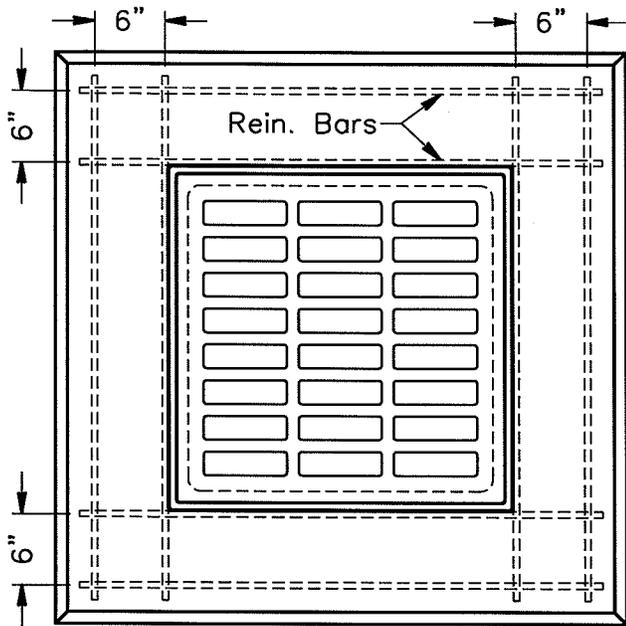
SECTION A-A

NOTES:

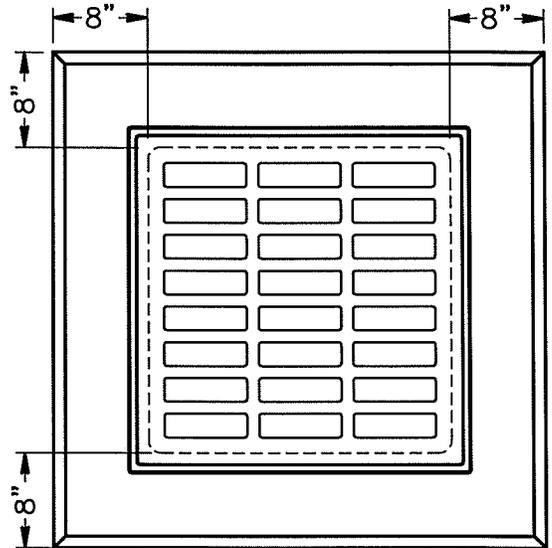
1. Concrete cast in place to be Class "C".
2. Brick or Concrete Block sidewalls, when used in place of concrete, shall be 8 inches nominal thickness. No Brick or Concrete Block shall be used above the flow line of the side opening nor within 6 inches of the inlet top.
3. Reinforcing in the top to be No. 4 bars 6 inches center to center. For 3 foot square ditch inlet, use 8 bars 2 ft. 8 in. long and for 4 foot square ditch inlet use 12 bars 3 ft. 8 in. long.
4. Flow line of a pipe discharging water into a ditch inlet shall be arranged whenever possible to have the top of such pipe at least as high as the top of the outlet pipe.
5. Side inlets to be placed 4 to 6 inches below normal elevation of side ditch. See sheet 2. Side inlets may be omitted when so stated on the plans or at the discretion of the Engineer.
6. Steps shall be provided where the depth exceeds 48 in.
7. Size of ditch inlet to be determined by size of outlet pipe: 12"-18"=2'X2'; 21"-30"=3'X3'; and 33"-42"=4'X4'.
8. Pre cast structures must be stamped or have identification noting that said pre cast concrete structures have been inspected by the City of Grove City and meets their specifications. Structures without proper identification will not be permitted for installation.

1/2

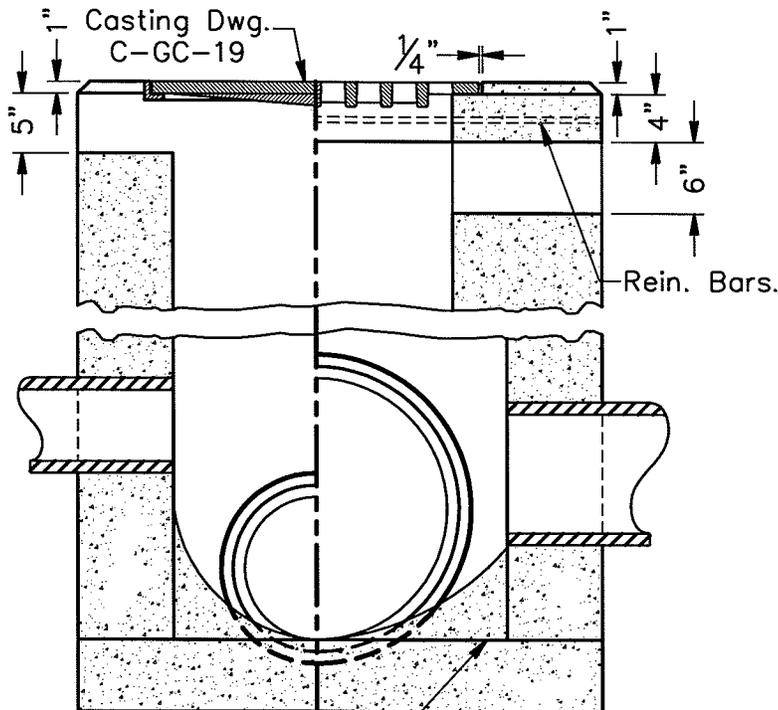
<p>DITCH AND SURFACE INLET</p>	<p>CITY OF GROVE CITY, OHIO</p>		
	<p>STANDARD CONSTRUCTION DRAWING</p>		
	<p>Effective Date X</p>	<p>Revision Date 2-02-06</p>	<p>Drawing Number C-GC-4</p>



TOP OF 2' X 2' DITCH
INLET WITHOUT SIDE INLETS

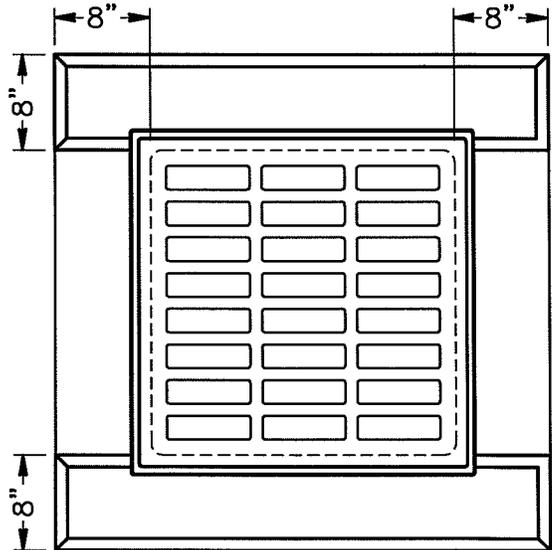


TOP OF 2' X 2' DITCH
INLET WITHOUT SIDE INLETS



HALF 2' X 2'
WITH SIDE INLETS

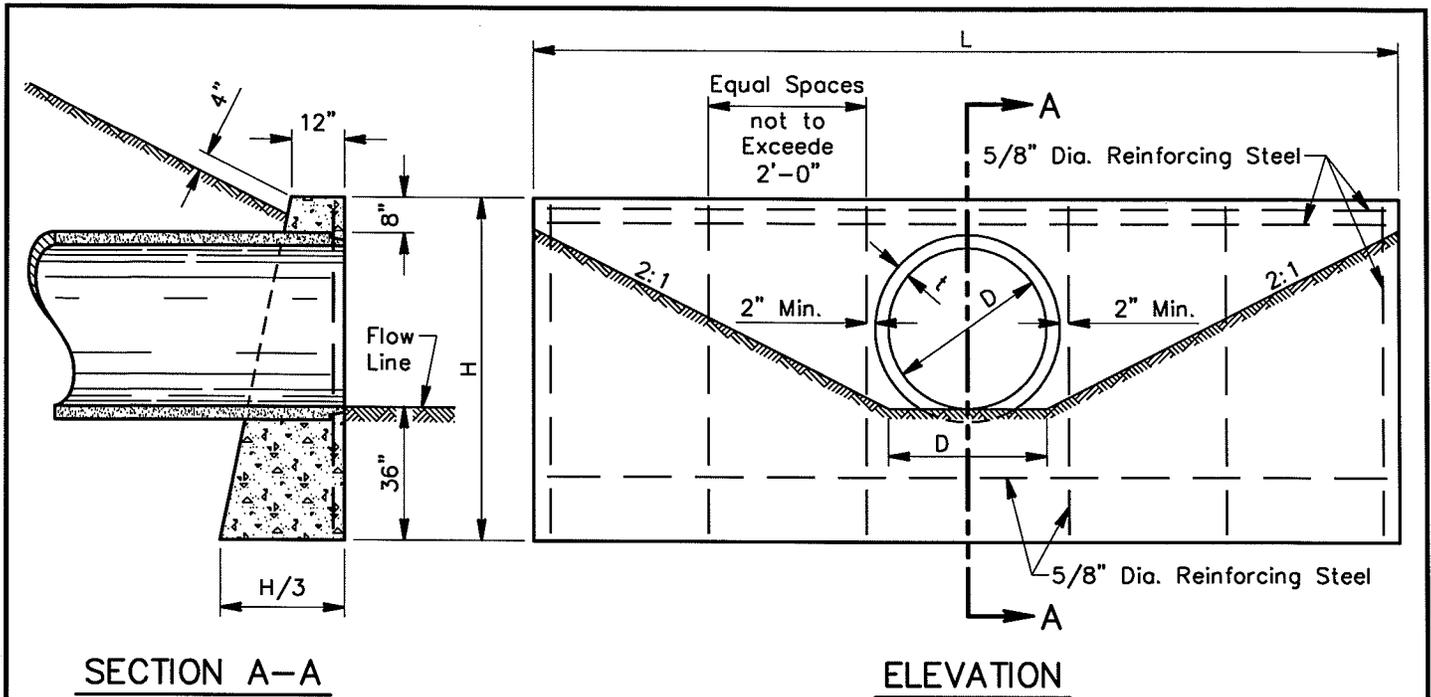
HALF 3' X 3' &
4' X 4' WITH SIDE INLETS



TOP OF 2' X 2' DITCH
INLET WITH SIDE INLETS

2/2

<p>DITCH AND SURFACE INLET</p>	<p>CITY OF GROVE CITY, OHIO</p>		
	<p>STANDARD CONSTRUCTION DRAWING</p>		
	<p>Effective Date X</p>	<p>Revision Date 2-02-06</p>	<p>Drawing Number C-GC-4</p>



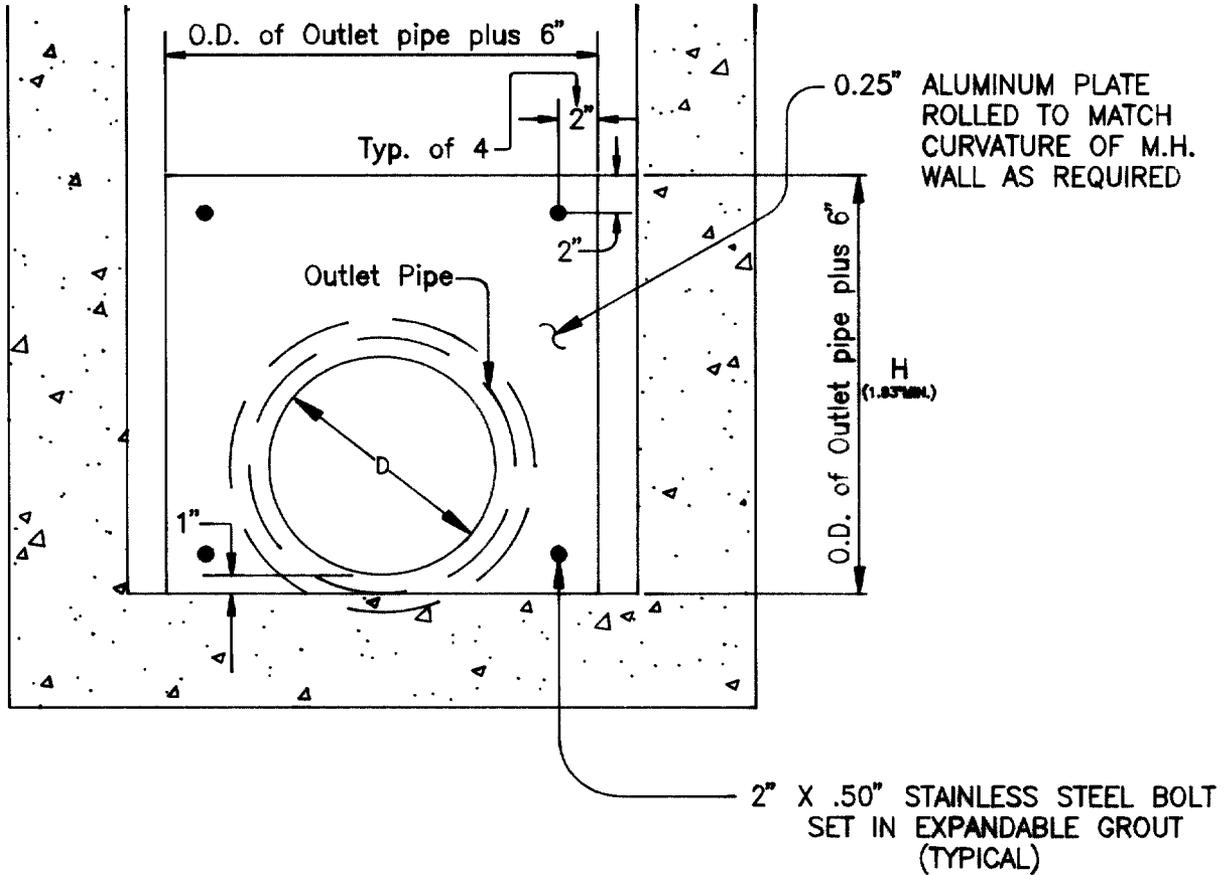
DIMENSIONS			QUANTITIES	
D	H	T	Concrete Cu. Yds.	Reinforcing Steel Lbs.
15"	5'-2"	7'-0"	1.7	41
18"	5'-5"	8'-4"	2.2	57
21"	5'-8"	9'-8"	2.8	62
24"	5'-11"	11'-0"	3.3	69
30"	6'-5"	13'-8"	4.7	92
36"	7'-0"	16'-4"	6.5	105

$L = \text{Circular Sections} = 5D + 4t$
 $L = \text{Elliptical or Pipe-Arch} = 4R + 4t + S$
 $H = \text{Circular Sections} = D + t + 44"$
 $H = \text{Elliptical or Pipe-Arch} = R + t + 44"$

$D = \text{Diameter of Pipe}$
 $R = \text{Rise of Pipe}$
 $S = \text{Span of Pipe}$
 $t = \text{Thickness of Barrel}$
 $L = \text{Length of Headwall}$
 $H = \text{Height of Headwall}$

1. Headwall where required will be provided for nonskewed culverts having a diameter or rise of 36" or less.
2. Concrete shall be Class "C".
3. Reinforcing Steel Bars shall be No. 5 round bars.
4. Dimensions and Quantities are shown for circular pipe sections only. It will be necessary to determine dimensions for the headwall required for reinforced elliptical concrete pipe or corrugated metal pipe arches in accordance with the equations listed on this drawing.

PIPE HEADWALL	CITY OF GROVE CITY, OHIO		
	STANDARD CONSTRUCTION DRAWING		
	Effective Date X	Revision Date 2-1-06	Drawing Number C-GC-24



Orifice sizing Equation

$$Q = CA(2gH)^{1/2}$$

Q = Peak Discharge Rate, cfs

C = Coefficient of Discharge.
dimensionless, (use nominal
value of 0.60)

A = Cross sectional Area of Orifice,
square feet

g = Acceleration due to Gravity,
32.16 ft/sec/sec

H = Head on the Orifice, feet

ORIFICE PLATE TO BE SET ON OUTLET PIPE
WALL AT EACH BASIN INDICATED ON PLAN.

[Signature]
STORMWATER PROGRAM MANAGER

[Signature]
ADMINISTRATOR

OUTLET
CONTROL
ORIFICE
PLATE

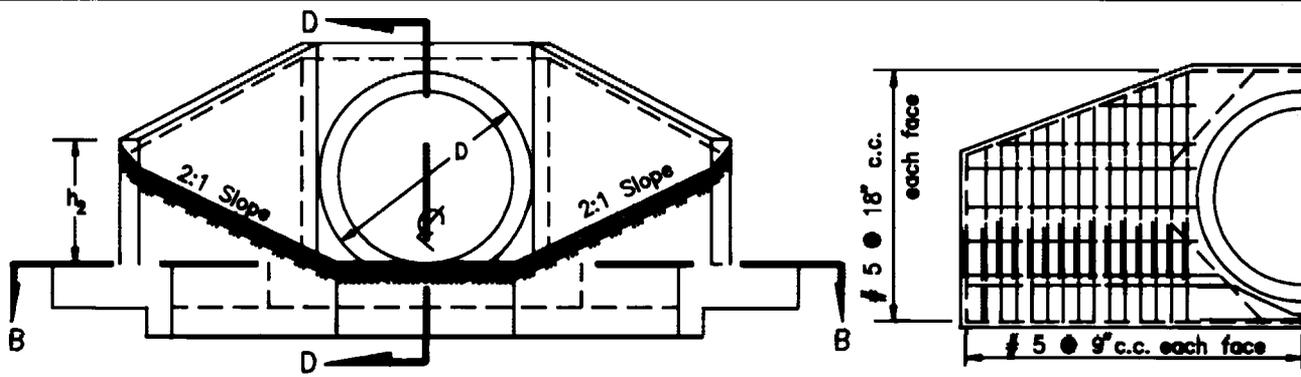
CITY OF COLUMBUS
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF SEWERAGE & DRAINAGE

STANDARD
CONSTRUCTION DRAWING

12/15/93
APPROVED

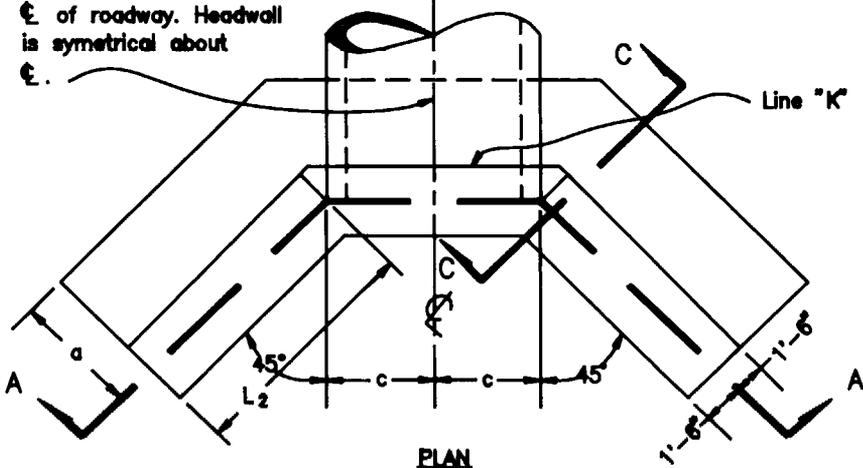
REVISED

DR. G.L.C. SHEET 1 OF 1 FILE NO. AA-S145
CK. DJH

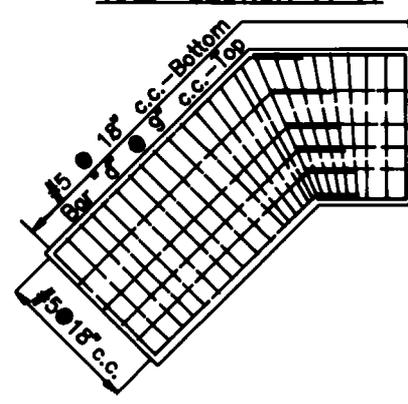


℄ of culvert normal to
℄ of roadway. Headwall
is symmetrical about
℄.

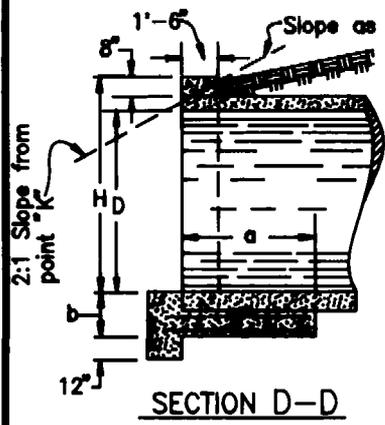
HALF-SECTION A-A



PLAN
TYPE "A"

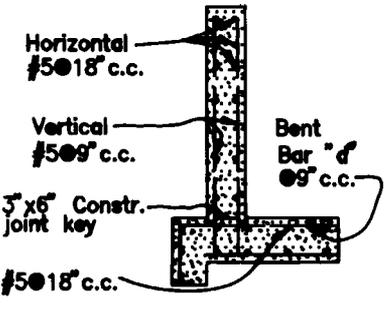


HALF-SECTION B-B

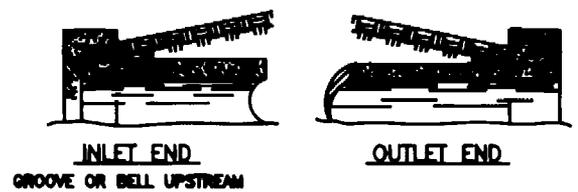


SECTION D-D

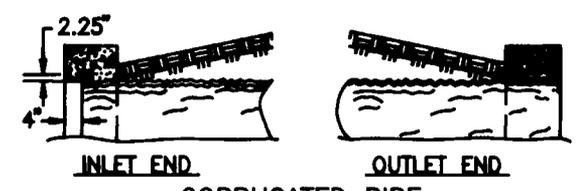
*One Wall



SECTION C-C



RIGID PIPE



CORRUGATED PIPE

END TREATMENT OF HEADWALL

PIPE DIAM. D	H	a	b	c	BAR "d"	∅ = 0°				∅ = 15°				CONT. on SHEET 2 of 2			
						L ₂	h ₂	C.Y. CONC. C.M.P.	C.Y. CONC. R.C.P.	STEEL lbs.	L ₁	L ₂	h ₁		h ₂	C.Y. CONC. C.M.P.	C.Y. CONC. R.C.P.
42"	4'-11"	3'-3"	1'-6"	2'-6"	#5	3'-7"	3'-1"	7.0	6.7	598	8'-9"	4'-6"	3'-8"	3'-2"	7.3	7.1	619
48"	5'-5"	3'-6"	1'-6"	2'-6"	#5	4'-4"	3'-4"	8.5	8.2	793	10'-0"	5'-4"	4'-1"	3'-5"	9.0	8.7	776
54"	5'-11"	3'-9"	1'-6"	3'-0"	#5	5'-2"	3'-8"	10.3	10.0	1,069	11'-4"	6'-3"	4'-6"	3'-8"	10.9	10.5	1,026
60"	6'-6"	4'-0"	1'-6"	3'-3"	#5	5'-11"	3'-11"	12.3	11.8	1,149	12'-7"	7'-2"	4'-10"	4'-0"	12.9	12.4	1,174
72"	7'-7"	4'-6"	1'-7"	3'-9"	#7	7'-5"	4'-5"	17.0	16.2	1,783	15'-1"	8'-11"	5'-7"	4'-6"	17.8	17.1	1,811
84"	8'-8"	5'-0"	1'-10"	4'-3"	#8	9'-0"	5'-0"	23.7	22.8	2,595	17'-7"	10'-9"	6'-4"	5'-1"	24.8	23.9	2,596

W. J. ...
STORMWATER PROGRAM MANAGER

Jerry Francis
ADMINISTRATOR

12/15/93
APPROVED

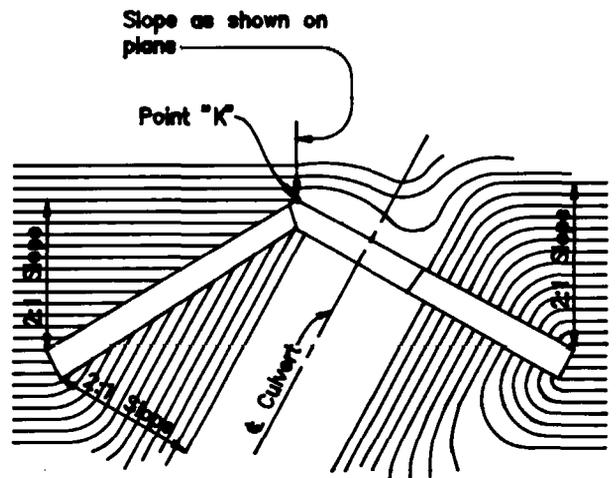
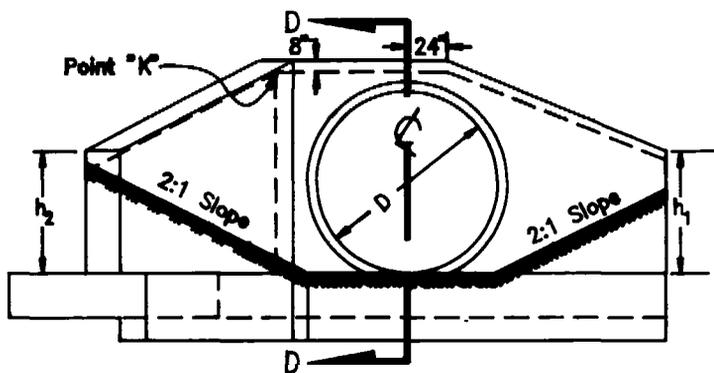
REVISED

CAST IN PLACE
PIPE CULVERT
HEADWALLS
42" to 84"

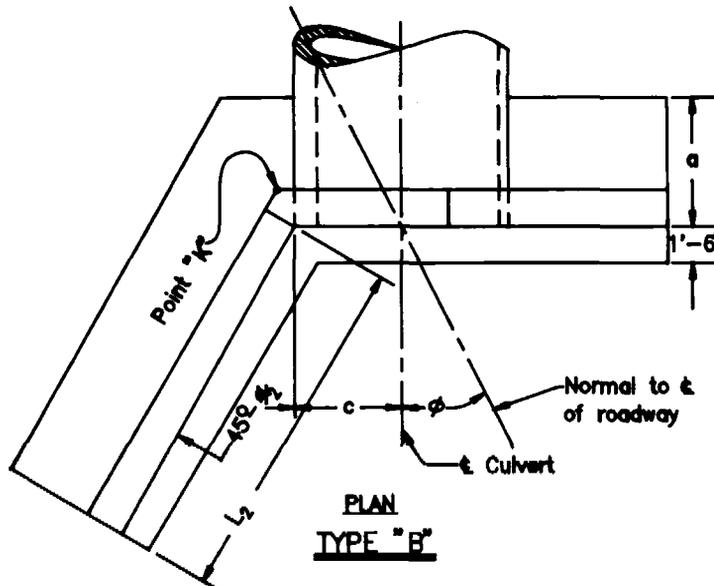
CITY OF COLUMBUS
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF SEWERAGE & DRAINAGE

STANDARD
CONSTRUCTION DRAWING

DR. CAW SHEET 1 FILE NO.
CK. DJH OF 2 AA-S167



LOCATION AND GRADING PLAN
FOR SKEWED PIPE CULVERT-TYPE "B"



PLAN
TYPE "B"

NOTES:

Headwall where required will be provided for skewed and nonskewed culverts having a diameter or rise of 42" to 84" inclusive. Type "A" is used when the skew angle (θ) is 10° or less and Type "B" when the skew angle is 11° or over.

Reinforcing Steel Bars shall be 3/8 inch round.

Dimensions and quantities are shown for circular sections only. When used with reinforced elliptical concrete pipe or corrugated metal pipe arches it will be necessary to determine such dimensions and quantities which shall generally conform with those listed for the nearest size circular pipe. The dimensions established by vertical diameter shall apply to rise and the dimensions established by horizontal diameter shall apply to span.

Foundation: Where the soil borings indicate a bearing capacity of less than 2600 pounds per square foot it will be necessary to increase the width of the footing.

Concrete shall be Class "C".

Headwall location to be determined by the intersection of the embankment slope at the back of the headwall at point "K". The slopes adjacent to the headwall shall be 2:1.

If slopes other than 2:1 are used, the Length L_1 & L_2 , and Height h_1 & h_2 will require adjustment.

PIPE DIAMETER D	H	a	b	c	BAR # ϕ	$\theta = 30^\circ$				$\theta = 45^\circ$									
						L_1	L_2	h_1	h_2	C.Y. CONC. C.M.P.	C.Y. CONC. R.C.P.	STEEL lbs.	L_1	L_2	h_1	h_2	C.Y. CONC. C.M.P.	C.Y. CONC. R.C.P.	STEEL lbs.
42"	4'-11"	3'-3"	1'-6"	2'-6"	#5	7'-10"	5'-9"	3'-2"	3'-3"	7.5	7.3	633	7'-10"	7'-9"	3'-2"	3'-3"	8.7	8.5	718
48"	5'-5"	3'-6"	1'-6"	2'-9"	#5	8'-9"	6'-10"	3'-5"	3'-6"	9.1	8.8	801	8'-9"	9'-2"	3'-5"	3'-7"	10.6	10.3	925
54"	5'-11"	3'-9"	1'-6"	3'-0"	#5	9'-8"	7'-11"	3'-8"	3'-9"	10.8	10.5	1,024	9'-8"	10'-7"	3'-8"	3'-10"	12.6	12.2	1,188
60"	6'-6"	4'-0"	1'-6"	3'-3"	#5	10'-7"	9'-0"	3'-10"	4'-1"	12.7	12.3	1,157	10'-7"	12'-0"	3'-10"	4'-1"	14.8	14.3	1,354
72"	7'-7"	4'-6"	1'-7"	3'-9"	#7	12'-5"	11'-2"	4'-3"	4'-7"	17.3	16.6	1,788	12'-5"	14'-10"	4'-3"	4'-8"	20.2	19.6	2,076
84"	8'-8"	5'-10"	1'-10"	4'-3"	#8	14'-7"	13'-4"	4'-10"	5'-2"	24.1	23.3	2,511	14'-3"	17'-8"	4'-8"	5'-2"	27.9	27.0	2,990

W. H. ...
STORMWATER PROGRAM MANAGER

Jay Francis
ADMINISTRATOR

12/15/93
APPROVED

REVISED

CAST IN PLACE
PIPE CULVERT
HEADWALLS
42" TO 84" DIA.

CITY OF COLUMBUS
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF SEWERAGE & DRAINAGE

STANDARD
CONSTRUCTION DRAWING

DR. CAW SHEET 2 FILE NO.
CK. DJH OF 2 AA-S167

TABLES

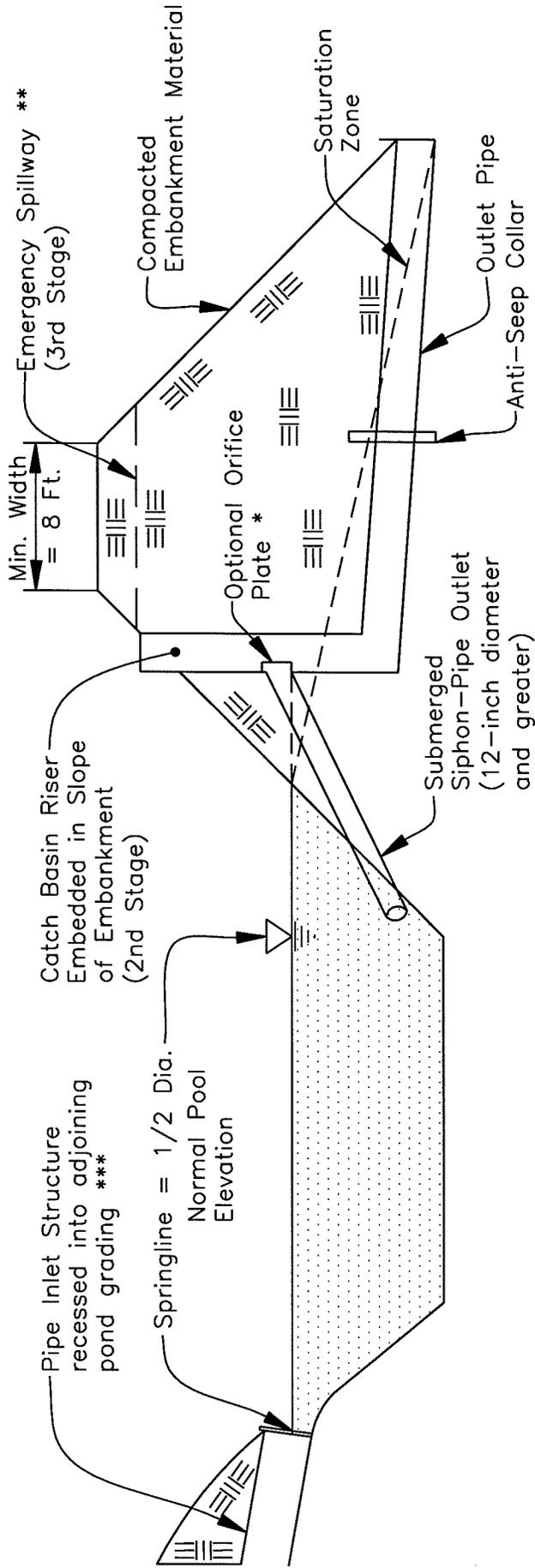
Table 1. Approved Wetland Vegetation List

Type	Botanical Name	Common Name
Herbaceous Plants	<i>Acorus americanas</i>	Sweet flag
	<i>Alisma</i>	Common water plantain
	<i>Asclepias incarnata</i>	Swamp milkweed
	<i>Aster novae-angliae</i>	New England aster
	<i>Aster umbellatus</i>	Flat-top aster
	<i>Carex comosa</i>	Bristley sedge
	<i>Carex crinita</i>	Fringed sedge
	<i>Carex frankii</i>	Bristley cattail sedge
	<i>Carex grayi</i>	Common bur sedge
	<i>Carex lacustris</i>	Common lake sedge
	<i>Carex lupulina</i>	Common hop sedge
	<i>Carex lurida</i>	Bottlebrush sedge
	<i>Carex stricta</i>	Common tussock sedge
	<i>Carex tribuloides</i>	Awl-fruited oval sedge
	<i>Carex vulpinoidea</i>	Brown fox sedge
	<i>Chelone glabra</i>	Turtlehead
	<i>Eleocharis obtusa</i>	Blunt spike rush
	<i>Elymus canadensis</i>	Canada wild rye
	<i>Elymus riparius</i>	Riverbank wild rye
	<i>Elymus virginicus</i>	Virginia wild rye
	<i>Eupatorium fistulosum</i>	Hollow joe-pye weed
	<i>Eupatorium maculatum</i>	Spotted joe-pye weed
	<i>Eupatorium perfoliatum</i>	Common boneset
	<i>Gentiana andrewsii</i>	Bottle gentian
	<i>Hibiscus laevis</i>	March hibiscus
	<i>Ilex verticillata</i>	Winterberry
	<i>Juncus canadensis</i>	Canadian rush
	<i>Juncus effusus</i>	Common rush
	<i>Juncus tenuis</i>	Path rush
	<i>Leersia oryzoides</i>	Rice cut grass
	<i>Lobelia siphilitica</i>	Great blue lobelia
	<i>Ludwigia alternifolia</i>	Seedbox
	<i>Lythrum alatum</i>	Winged loosestrife
	<i>Mimulus ringens</i>	Monkey flower
	<i>Nelumbo lutea</i>	Lotus (clay ball)
	<i>Nupher advena</i>	Yellow pond lily
	<i>Nymphaea tuberosa</i>	White water lily (rooted buds)
	<i>Peltandra virginica</i>	Arrow arum
	<i>Penthorum sedoides</i>	Ditch stonecrop
	<i>Physostegia virginiana</i>	Obedient plant
	<i>Pontederia cordata</i>	Pickerel weed
	<i>Potamogeton natans</i>	Common pondweed
<i>Potamogeton pectinatus</i>	Sago pondweed	

Table 1. Approved Wetland Vegetation List

Type	Botanical Name	Common Name
Herbaceous Plants	<i>Sagittaria latifolia</i>	Common arrowhead
	<i>Saururus cernuus</i>	Lizard's tail
	<i>Scirpus acutus</i>	Hard-stemmed bulrush
	<i>Scirpus americanus</i>	Chairmaker's rush
	<i>Scirpus atrovirens</i>	Dark green rush
	<i>Scirpus cyperinus</i>	Wool grass
	<i>Scirpus fluviatilis</i>	River bulrush
	<i>Scirpus pungens</i>	Chairmaker's rush
	<i>Scirpus tabernaemontani</i>	Soft-stem bulrush
	<i>Scirpus validus</i>	Great bulrush
	<i>Solidago ohioensis</i>	Ohio goldenrod
	<i>Solidago riddellii</i>	Riddell's goldenrod
	<i>Sparganium americanum</i>	American bur reed
	<i>Sparganium eurycarpum</i>	Common bur reed
	<i>Verbena hastata</i>	Blue vervain
	<i>Verbesina alternifolia</i>	Wingstem
Shrubs	<i>Amorpha fruticosa</i>	Indigo bush
	<i>Rosa palustris</i>	Swamp rose
	<i>Cephalanthus occidentalis</i>	Buttonbush
	<i>Cornus amomum</i>	Silky dogwood
	<i>Cornus sericea</i>	Red-osier dogwood
	<i>Ilex verticillata</i>	Winterberry
	<i>Salix amygdaloides</i>	Peachleaf willow
	<i>Salix discolor</i>	Pussy willow
	<i>Salix nigra</i>	Black willow
	<i>Salix sericea</i>	Silky willow
<i>Spiraea tomentosa</i>	Steeple bush	

EXHIBITS



* Refer to City of Columbus Std. Dwg. AA-S145

** Reinforced with Erosion Control Material

*** Pipe inlets \geq 36-inches in diameter must be Submerged to the SpringLine.

SUBMERGED OUTLET AND EMBANKMENT DETAIL

EXHIBIT No. 1

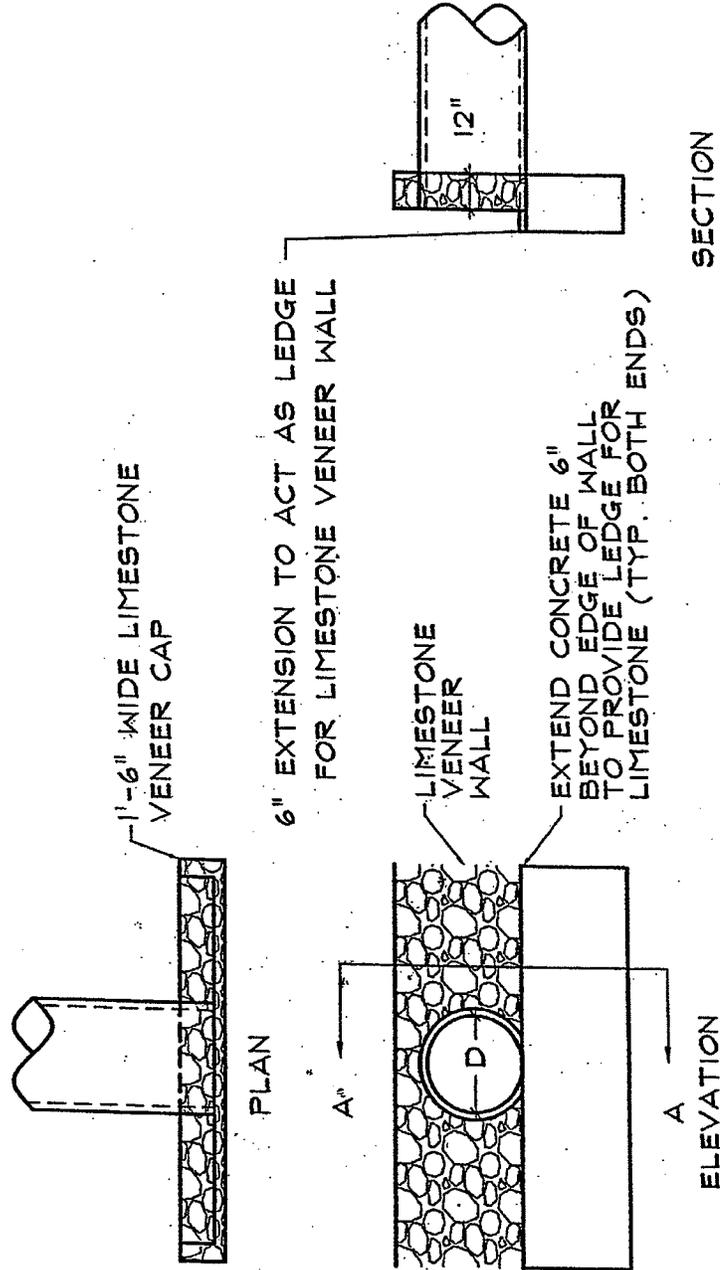
Date: January 10, 2006

Job No.

Scale: N.T.S.

NOTE:

- * STONE FACING SHALL BE ON ALL EXPOSED SURFACES OF THE OUTLET STRUCTURES.
- * STONE IS TO BE NORTH SHORE BLUFF LIMESTONE. ALTERNATE SELECTIONS MUST BE APPROVED BY THE CITY SERVICE DIRECTOR.
- * 1/2" MAX DRY LAID LOOK JOINTS HOLD MORTAR BACK 3" MIN.
- * VARY THICKNESS OF ADJACENT HORIZONTAL STONE COURSES. WHENEVER POSSIBLE LAY LARGE CHUNKS AND FILL IN AROUND WITH THINNER STONES.

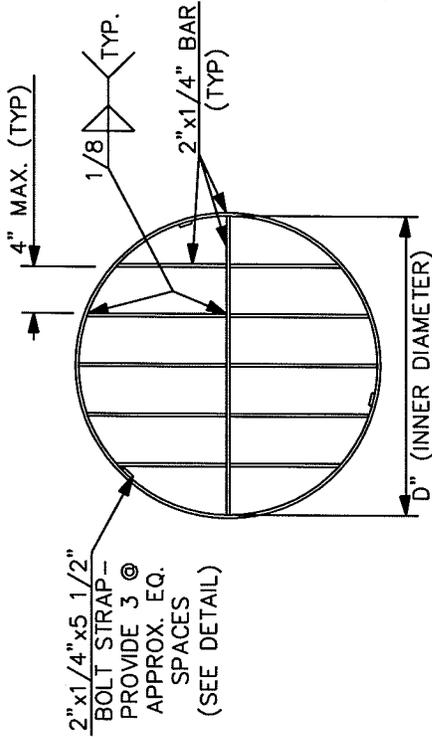


**STONE FACING DETAIL
FOR HEADWALLS AND ENDWALLS**
EXHIBIT No. 2

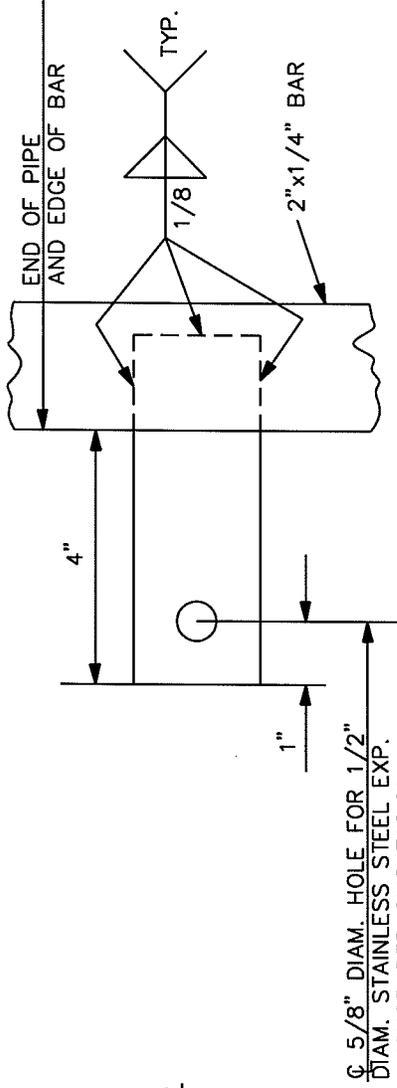
Date: January 10, 2006

Job No.

Scale: N.T.S.



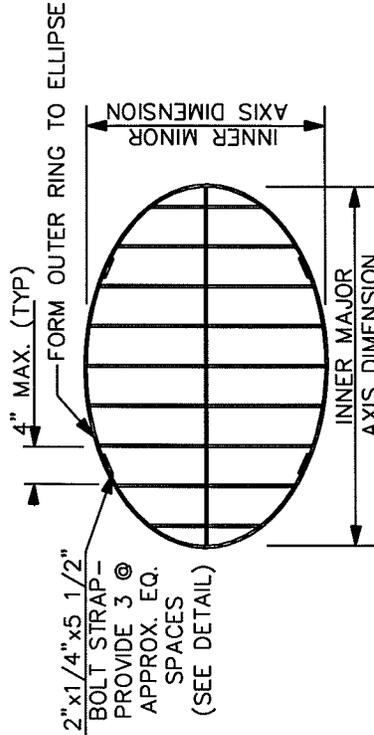
SAFETY GRATE DETAIL



BOLT STRAP DETAIL

Notes:

1. Grates shall be fabricated from ASTM A-36 steel and be galvanized in accordance with CMS 711.02.
2. Geometry, size and shape may be revised to accommodate box culvert outlets.



SAFETY GRATE DETAIL

Riverside Drive and Hannah Hills Drive

TRASH RACK DETAIL
EXHIBIT No. 5

Date: January 10, 2006

Job No.

Scale: N.T.S.